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lunar occultations may partly arise from this source. Observers have often stated that, previous to an occultation, the focus of the telescope has been carefully adjusted on a small and close double star: and if, with that focus, the disappearance of a star be observed at the bright edge of the moon, the probability is that, the greater stimulation of the eye having altered its focus, some clinging to the moon's edge, or even projection on its disk, may be the result. The involuntary shortening of the focus of the eye under the stimulus of light, evidently arises from the diminution of the pupil and the consequent drawing forward of the crystalline lens, and is analogous to the variation produced by looking at near and remote objects: but it is very possible that the amount of variation required in the adjustment of the focus of a telescope may differ with different degrees of sensibility in the eye.

"I would beg leave to suggest to those observers who intend to look out for the delicate phenomena attending a total eclipse of the sun, such as Baily's beads and the red flames in the corona, that it might be well to keep this fact in view, which does not appear to be so generally known as it deserves: at least, among those to whom I have mentioned the subject, there was no one who seemed to be aware of it.

"It would seem highly desirable that this or some other equally efficient method of employing the whole aperture should be adopted in observing the sun's transit with large instruments, and in measuring his diameter with large meridian circles and heliometers. The diameter of the sun, as well as of all other celestial bodies, is unquestionably smaller with a large aperture than with a small one, provided the state of the atmosphere is not too unfavourable for its advantageous employment. Though the difference is not so striking on objects having a sensible diameter as on the disks of the fixed stars, yet it exists; and may be readily subjected to experiment in any large telescope whose whole aperture is sufficiently perfect."

Remarks on the Observations of the Obscure Portion of Saturn's Ring, made by Dr. Galle, at Berlin, in the year 1838. By the Rev. W. R. Dawes.

"In the *Astronomische Nachrichten*, No. 756, there is a paper by Dr. Galle, dated 1851, April 1, in which he refers to a communication of Professor Encke's, published in the *Transactions of the Berlin Academy of Sciences* for 1838, as containing some observations on the dark ring of *Saturn*, made by Dr. Galle with the Berlin refractor, which is, I believe, of the same dimensions as the refractor at Dorpat (aperture 9 inches, and focal length 14 feet, Paris measure), and by the same maker.

"On referring to the volume in the Society's library, I found that no part of it was cut open. Professor Encke's paper is illustrated by two pictures of *Saturn*, in which the exterior ring is shown with a broad division at the ansæ, nearly in the middle of

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its breadth. But there is no indication in the pictures of any encroachment of the inner ring on the black interval between it and the ball. On looking into the paper itself, however, I find the following remarks on this point by Dr. Galle, who is stated to have been the principal observer with the large refractor in the year 1838.

" '1838, May 8. Air very good. The inner edge of the inner ring is faded.

" 'May 25. The dark space between *Saturn* and his ring seemed to M. Galle to consist, as far as its middle, of the gradual extension of the inner edge of the ring into the darkness, so that the fading of this inner ring has considerable breadth.

" 'June 10. The inner edges of the first ring fade away gradually into the dark interval between the ring and the ball. It seemed, if no illusion exists, that the ring. from the beginning of the shading inclusive, extends over nearly half the space towards the ball of *Saturn*.

" 'June 15. *Saturn* very distinct. The fading of the inner ring towards *Saturn*, as on June 10.'

"No measurements of this appearance are given in Encke's paper; indeed he does not appear to have seen anything of it himself: and it is to be observed that the pictures refer to the aspect of the planet as seen by him 1837, April 25; and 1838, March 10; being before the observations of Galle, who has recently published (in No. 756 of the *Astronomische Nachrichten*), six days' micrometrical measurements subsequently obtained by himself. These show that he saw the obscure portion of the ring encroaching on the black interval between the ring and the ball to almost precisely the same extent as it appeared to myself at the last apparition of the planet, namely, about 2″. This is a peculiarly interesting fact, as rendering it highly probable that this is really the interior *limit* of the obscure ring. And this idea is supported by the small breadth of the dark line formed by its projection on the ball; which, in fact, appears to be so narrow as scarcely to be consistent with the visible breadth of the dark ring at the ansæ. It is remarkable that no intimation is given by Dr. Galle, that this projection was seen either by himself or any other observer; nor does it appear to have occurred either to Encke, Galle, or Mädler (who is referred to in Galle's observations), that so dull an appendage would be visible as a dark line upon the ball. But, since the ring presented at that time a very broad ellipse, such a dark line would be much broader and more visible than it was last winter. Why then, it may be asked, was it not observed on some of the very favourable nights on which the planet was scrutinised by the observers at the Berlin observatory? I think we may be justified in replying, that *it actually was seen*, but that its nature was not apprehended. For, in both the pictures appended to Encke's paper, there is a dark shading of considerable breadth below, or to the north of, the inner edge of the ring where it crosses the ball, which appears to be intended for the shadow of the ring upon the

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ball. But the fact is, that on 1837, April 25, the elevation of the earth above the plane of the ring exceeded the elevation of the sun above the same plane by only 0′·7, according to the data in the *Nautical Almanac*; and consequently the visible shadow of the ring upon the ball must have been an excessively narrow line. And on 1838, March 10, the elevation of the earth above the plane of the ring was *precisely the same* as that of the sun; and there could therefore at that time be *no visible shadow* of the ring upon the planet. The shading in both the engravings must therefore, I imagine, have been *the obscure portion of the ring projected upon the ball*; but it was not recognised as such; and, consequently, the entire phenomenon was not so completely made out as it might have been. Yet Professor Encke seems to have had no doubt of the reality of Galle's observations; for, at the close of his paper, having referred to an observed apparent excentricity of *Saturn's* position in his ring, he uses the following remarkable language:—

" 'I find it remarked in my journal on one occasion only, 1837, June 20, $16^h\ 45^m$ sidereal time, that I thought such an appearance was visible, so that the space between *Saturn* and the ring seemed rather greater on the right side in the telescope (the eastern) than on the left (the western). Probably the foregoing remark of M. Galle, that the gradual decrease of light of the inner ring towards the body of *Saturn* appeared to him to extend far into the interval between *Saturn* and the ring, may furnish an explanation. It does not appear that he was on any occasion deceived; since on the four days on which he measured *Saturn*, he has measured the wide extent of the dark covering; and on all the four days found it, with great accordance, of the same dimension. At least it would appear from this, that different eyes are able to see very differently the inner limit of the inner ring; and that even the relative estimation of the proportion of the two ansæ depends upon the observer himself.'

" It is to be regretted that Dr. Galle's observations and measures were not published in the *Astronomische Nachrichten* soon after they were made; as they would long since have directed attention to this remarkable phenomenon.

" It is interesting to remark that at that time the *northern* surface of the ring was visible, while at present the southern is seen; and that it may consequently be inferred, that no appreciable difference exists in the reflective power of the two surfaces of the dull portion.

" In looking for its projection on the ball at the ensuing apparition of the planet, it should be borne in mind, that when the elevation of the earth above the plane of the ring *exceeds* that of the sun, the shadow of the ring on the ball is visible at the interior (or southern) edge of the ring where it crosses the planet; and that therefore the projection of the dark ring, falling upon this shadow, will be invisible. This will be the case till October 18. It may also be much obscured if it should be projected on a dark belt; and it seems very probable that this may often have been the cause

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of its having formerly been overlooked. It may even have been mistaken for a very narrow and unusually dark belt; or for a portion of one, the rest being concealed by the bright ring crossing the planet. The position of the ring subsequently to the beginning of last October, was especially favourable to its visibility; for it was projected on to the very bright region extending from the planet's centre towards its north pole, by contrast with which it would appear unusually dark."

On a Photometrical Method of Determining the Magnitudes of Telescopic Stars. By the Rev. W. R. Dawes.

"The magnitudes of telescopic stars are so variously assigned by different observers, as to render it impossible correctly to anticipate the appearance of such an object in a telescope of any particular kind and dimensions, without having reference to the scale of magnitudes adopted by the observer who has assigned the magnitude of the star in question; and even then it is necessary to suppose that his habit of estimating is fixed and tolerably uniform. The differences among observers of great experience and celebrity are much greater than would probably be imagined by those who have not been led to examine the subject, and clearly show that widely different *scales* of magnitude have been adopted; and though, provided each observer's habit of estimation is generally consistent with his own scale, it might not be very difficult to convert the magnitudes of one into those of another, yet the trouble of this is to be deprecated; and the different numerical denominations of the magnitude of the same star create complication and confusion where simplicity and uniformity are especially desirable.

"In examining the estimated magnitudes by different observers, one remarkable fact presents itself; namely, that there is a tendency common to almost all to underrate the magnitudes of stars when seen through a telescope. This is most strikingly exemplified by observations of stars visible with the naked eye, and whose magnitudes may therefore be estimated without telescopic aid. The following instances will afford illustrations of this:—

"ζ *Cancri.* This triple star is obvious to the naked eye, and is designated by Argelander, in his *Uranometria Nova*, as of magnitude 5·4 (or about 4·7). Telescopically its three components have been estimated thus: by Sir James South (S), 7, 8, 8; by Sir John Herschel (H), 8, 8½, 8½; by Struve (Σ), 5·0, 5·7, 5·5: the latter therefore agreeing with Argelander (A).

"32 *Orionis.* Obvious to the naked eye, and designated by A as 5·6 (or about 5·3); by H, 7½ and 8½ (mean of two estimations); by Σ, 5·2 and 6·7, nearly agreeing with A.

"ζ *Aquarii.* A double star whose components are nearly equal, appearing to the naked eye as a bright 4 mag., and designated by